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THE GENUS *VERONICA (SCROPHULARIACEAE)* IN CROATIA

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Abstract: Three species mentioned so far in the literature very probably do not really occur in this country or have not been reliably recorded up to now and, therefore, are to be cancelled from the Croatian Flora (marked by ** in the text): *V. fruticulosa*, *V. fruticans*, *V. dentata (= V. austriaca* subsp. *dentata)*; two species have not been recorded but might be present (*): *V. dillenii*, *V. scardica*; four species, whose occurrence in Croatia has been unknown or has been neglected by modern standard Floras, are confirmed or recorded for the first time (●): *V. sublobata*, *V. prostrata*, *V. vindobonensis*, *V. catenata*; ten species have been or still are problematical in some respects (◻): *V. alpina*, *V. praecox*, *V. triphyllos*, *V. verna*, *V. agrestis*, *V. opaca*, *V. triloba*, *V. hederifolia* s. str., *V. orbiculata*, *V. anagalloides*. - Unsolved taxonomical and/or ecogeographical problems concerning *V. serpyllifolia*, *V. agrestis* group, *V. hederifolia* group, *V. austriaca* group, *V. chamaedrys* group, *V. anagallis-aquatica* group are mentioned and/or discussed. The ecogeographical (including coenological) characteristics of all the Croatian species are briefly surveyed.

Introduction

A revision of the genus *Veronica* s. str., i. e., excluding *Pseudolysimachion* and *Paederota* (see FISCHER & BEDALOV 1989), mainly in the herbaria ZA, ZAHO (both Zagreb) and W, WU (both Vienna), offered, on the one hand, doubts about the occurrence of some species (some mistakes have accumulated by reiteration of data from old Floras and neglection of later corrections in scattered floristic papers), and, on the other hand, we give evidence for the presence of certain species that hitherto have been neglected, mistaken or taxonomically not distinguished for Croatia. Furthermore, we try to give a characterization of the distribution in Croatia for each species. As chorological behaviour is largely dependent on ecology, we also mention some ecological data including plant communities (phytosociological units) in order to try to survey the ecogeographical position of the Croatian *Veronica* species. Those coenological data have been extracted from a ± random selection of relevant papers, i. e., they are incomplete but merely try to illustrate the ecological distinctness and indicator value of the individual species and, generally speaking, to provide a necessary connection between taxonomy, floristics, and phytosociology. As a conclusion of this study, we strongly recommend phytocoenological workers to produce voucher specimens for any "critical" species and to deposit them in a public herbarium. - Unsolved problems and hints for further research are discussed.

Unfortunately, it was not possible to publish this paper - together with FISCHER & BEDALOV (1989) - in Acta Botanica Croatica, due to its undue length.

Two asterisks (**) designates species that should be cancelled from the Flora of Croatia as there are no reliable records so far; one asterisk (*) indicates species that might occur in the country but are not at all recorded so far; the empty square (□) marks species whose occurrence in Croatia is problematic in some way, e. g., because they are underrecorded or many records are erroneous, having been mistaken or confused with other species; the black dot (●) designates species that have been doubtful but are confirmed by us and species new for the Flora of this country. - We use the term "continental" here in the climatological sense only, and not in the sense of many Croatian authors who refer to the inland part of the country in contrast to the (mediterranean) coastal parts and the islands. Most of inland ("continental") Croatia, actually, has a rather oceanic climate (Fagion illyricum zone and Carpinion betuli illyricum zone sensu HORVAT & al. 1974, see also JOVANOVIĆ & al. 1986) except for areas in the extreme northeast which have subcontinental climate, flora and vegetation.

Veronica (s. str.)

"Sect. *Veronicastrum*" (perennials with terminal inflorescence):

□ *V. alpina* L. (subsp. *pumila*). The presence of this species in Croatia remains doubtful as is indicated by DOMAC (1984) and by FISCHER & FISCHER (1981: 184, 224: fig. 4) who take this species as an example demonstrating the chorological phenomenon of the "Croatian Gap". The old record by KLINGGRÄFF (1861) for the "environment of Zagreb" was already cancelled by NEILREICH (1868). Its occurrence on mt Plješevica reported by REICHARDT (1867) and quoted by NEILREICH (1868: 136) and HIRC (1904: 190) has been doubted already by ROSSI (1913) and by DEGEN (1938: 18). In herb. ZA, there exists an old sheet in SCHLOSSER's herbarium, labelled "Risnjak, 8.1879" which is reported also by HIRC (1904: 190/130). Since that time, however, there exists no younger record - so, this is perhaps a parallel case to the mysterious presence of *Paederota bonarota* in SCHLOSSER's herbarium (FISCHER & BEDALOV 1989)?

** *V. fruticulosa* L. This is another example of a "ghost species" of the Croatian flora. HOST (1827: 9) reported this species for "Croatia" (among the other countries Carniolia, Friuli and Warm Tyrol), probably by mistake. This "record" has been taken over by NEILREICH (1868: 136), by SCHLOSSER & VUKOTINOVIĆ (1869) by HAYEK (1929: 159) and by DOMAC (1984) although its occurrence was never documented by any concrete locality record or herbarium specimen and although the presence of this species was strongly doubted by DEGEN (1938). Thus, there is not the slightest serious evidence for the occurrence of *V.*

fruticulosa in Croatia. This species, as a native, is absent from the whole of the Balkan Peninsula, within Yugoslavia it occurs only in Slovenia (see map in FISCHER & FISCHER 1981: 183, 227: fig. 7; FISCHER & WRABER 1984).

** *V. fruticans* JACQ. is still another type of a species doubtful for Croatia: After having been considered to be absent from this country (DEGEN 1938: 18) - while present very scatteredly in some adjacent Bosnian mountains, as an example for the "Croatian Gap" (FISCHER & FISCHER 1981) - we found a sheet in herb. ZAHO labelled "Hrvatsko Primorje: Draga, Brometum, 13.8.1956, herb. IVO HORVAT" which does not fit at all the ecology of this alpine species and therefore must be considered with suspicion (according to information from professor IVO HORVAT's diary, in this special case, a mislabelling cannot be excluded).

V. saturejoides VIS. is a beautiful and taxonomically rather isolated species endemic to the mountains of the NW. Balkan Peninsula. In Croatia, there is subsp. *saturejoides* only. This typical subspecies is endemic to Yugoslavia, where it has a continuous distribution area in the northern Dinaric system ranging from mt Sator in the N. to mt Gradište in the S. It is a member of the flora of the 3 republics Croatia, Bosnia & Hercegovina, and Crna Gora (= Montenegro) (FISCHER & FISCHER 1981: 188, 227: fig. 7; we could check specimens also from mt Biokovo). All records from further to the SE. (Kosovo, Serbia, Makedonia) refer to *V. thessalica* (fig. 2046 in DEMIRI 1983 as "*V. saturejoides*"), a taxonomically completely different species belonging to a different section (see FISCHER 1989b). - Ecology: Subalpine to alpine calcareous rocks, (1200-)1300-2000(-2100) msm; it has been reported from several alpine calcareous rocky communities (mainly from the Seslerion juncifoliae, see SILIC 1984: 121 and VOLARIĆ-MRSIĆ 1972, HORVAT & al. 1974: 607).

V. serpyllifolia L. is a rather variable species, common in N. Croatia and in the mountains of the S., but rare or lacking in the mediterranean and submediterranean parts of the country (recorded, however, for the island Molat NW of Zadar: DOMAC 1963). Populations in the subalpine habitats usually differ by dwarfy habit, few-flowered racemes and more intensively blue corollas, they are often separated on varietal or subspecific rank and they deserve further research (see also FISCHER 1989a). – Ecology: Damp and heavy soils in forests (on trails), damp and rich soils (pastures) in subalpine vegetation; in Polygonion avicularis, Arction lappae (both MARKOVIĆ-GOSPODARIĆ 1965), Agropyro-Rumicion (MARKOVIĆ 1973), Calthion (REGULA-BEVILACQUA 1980), Cynosurion (HULINA 1984), Arrhenatherion (HORVAT 1962, HULINA 1977, ILIJANIĆ & ŠEGULJA 1983), Molinio-Hordeion nodosi (ILIJANIĆ 1967); Alno-Quercion (Genisto-Quercetum roboris: Turopolje, Posavina: HORVAT 1938, GLAVAČ 1968a).

"Sect. *Pocilla*" (Annuals with terminal inflorescence):

V. acinifolia L. (including *V. ciliata* VUKOT. = "*V. hirsuta*" nom. nud. in SCHLOSSER & VUKOTINOVIĆ 1854: 116, see NEILREICH 1868: 136), according to the herbarium label notes (ZA), was rather frequent in arable land (on wet, heavy soil; according to TRINAJSTIĆ 1970b recorded for hoe weed communities like Setario-Galinsogetum) at lower altitudes in N. and E. Croatia; probably it became rarer in modern times as a result of intensification of agricultural management. This species is present also in coastal (mediterranean) areas, here perhaps in ± natural habitats as well: Kvarner: Krk (ruderal puddle: TRINAJSTIĆ 1970b); Dalmatia: Mljet (REGULA-B. & al. 1981, REGULA-B. & ILIJANIĆ 1984), Lastovo (TRINAJSTIĆ 1979), peninsula Pelješac: Stinjivac bay 3 km SE. of Drače, coastal macchia, slightly salty, sea-level, 16.4.1979 and 21.4.1981, M. A. FISCHER, WU!).

□ *V. praecox* ALL. seems to be rare as we could not find a single specimen with a definite Croatian origin locality, which is surprising because in the older literature it seems not to have been considered a rarity (SCHLOSSER & VUKOTINOVIĆ 1854: 116; 1869: 669). Maybe, old records are to be somewhat distrusted because of possible misidentification and confusion with other annual species (HIRC 1904). There are no old records for Slavonia and no for Dalmatia, in DEGEN's Flora Velebitica (1938) it is also not mentioned; the modern report in a Flora of Slavonia (RAUS & ŠEGULJA 1983) is not exactly recorded by a locality. ROSSI (1924, 1930) records it for Rijeka and Senj; in recent times it is recorded for the Vukomeričke Gorice (S. of Zagreb) (ŠEGULJA 1977a). Generally, *V. praecox* prefers warm and dry climate and habitats. In the SE. parts of the Balkan Peninsula, but also in parts of central Europe (MEUSEL & al. 1978), it occurs in natural steppic therophyte communities as well as as a weed in arable land. Evidently, it avoids regions of oceanic climate.

□ ***V. triphyllos*** L. is a similar case like *V. praecox*. Although indicated by SCHLOSSER & VUKOTINOVIĆ (1869) as "in agris et cultis totius Croatiae et Slavoniae", we found no definite locality records in the literature and only one single, very old herbarium sheet (fields near Zagreb, leg. KLINGGRÄFF, ZA!). It seems to be very rare or very neglected; on account of this record situation one should even doubt its occurrence in the country. This is rather surprising because, though chorologically somewhat similar to *V. praecox*, it is less strictly confined to xerothermic regions, and its distribution, consequently, is less patchy but more continuous (MEUSEL & al. 1978); therefore, in Croatia one should expect it to be more common than the preceding species.

V. arvensis L. is a very common species, probably distributed all over the country in therophytic sites in grassland, in arable land, in ruderal places, perhaps also in natural communities in the mediterranean areas; in the Velebit mts, according to DEGEN (1938), it is spread from sea-level up to 1200 msm. - Coenology: in Polygonion avicularis (ŠEGULJA 1970), Polygono-Chenopodion (TOPIĆ 1982), Sisymbrion, Onopordion, Arction lappae (all three MARKOVIĆ-G. 1965), Vulpio-Lotion (HORVATIĆ 1963, BIRAČ 1973, M. HEĆIMOVIĆ 1984), Arrhenatherion (HORVAT & al. 1974: 397, ILIJANIĆ & ŠEGULJA 1978, 1983, REGULA-B. 1980).

□ ***V. verna*** L. seems to be also rather rare. Although SCHLOSSER & VUKOTINOVIĆ (1869) report it for "whole Croatia" [i. e. exclusively Dalmatia and Slavonia and Istria and Kvarner archipelago] we found no herbarium specimens with any definite locality from there. There are literature records, however, from Senj (ROSSI 1930, HORVATIĆ & al. 1968) and from Tuhobić (E. of Rijeka) (ROSSI 1930); we saw one sheet from coastal rocks on the E. coast of Istria (Plomin Luka, 10.5.1984, H. MELZER!). - Ecology: TOPIĆ (1982, 1984) reports *V. verna* as a companion in the hoe weed association Galeopsido-Sperguletum arvensis (Polygono-Chenopodion) with constance degree I, but, alas, with no indication of the localities where she has observed this rare species. Considering the subcontinental total distribution and the occurrence in Central Europe, in N. Italy, in Serbia and in Bulgaria, its rare occurrence in Croatia might be surprising but it is possibly a parallel case to *V. triloba* which also seems to avoid the rather oceanic climate of central Croatia while being present at the coast and in the continental East.

* *V. dillenii* CRANTZ is not recorded at all for Croatia, but this pannonic species (Balkan distribution: FISCHER & FISCHER 1981: 192, 229: fig. 9) might be present in the easternmost, climatically continental parts of the country (in Baranja; Aceri-Quercion zone: BERTOVIĆ 1968, GLAVAČ 1968b; region of Aceri tatarici-Quercetum, see JOVANOVIĆ & al. 1986; see also the discussions under *Pseudolysimachion spurium* and *P. pallens*: FISCHER & BEDALOV 1989).

V. polita FR. is perhaps a rather common species, mainly in segetal and ruderal communities, probably distributed all over the country and particularly frequent in the mediterranean areas. This species is sometimes misidentified as *V. agrestis* (from which it had not been distinguished by very ancient authors, i. e. only before SCHLOSSER & VUKOTINOVIĆ 1857). - Coenology: there seem to be rather few phytosociological records: e. g. Panico-Galinsogetum (Polygono-Chenopodion) (TOPIC 1982; in mt Strahinščica, Hrvatsko Zagorje: REGULA-B. 1979); Eragrostion (TOPIĆ 1982). The record from Sipan island (M. HEĆIMOVIĆ 1981) possibly refers to *V. agrestis* (see below!)

□ ***V. agrestis*** **L.** is very rare in Croatia. Most of the old records and some more recent misidentifications refer to *V. polita* (the corolla in *V. agrestis* is not yellow but white or very pale bluish; for full descriptions and diagnostic characters see FISCHER 1987). It occurs probably at the coast (Gornji Majkovi between Trsteno and Slano, km 687, of old coastal road, field, 300 msm, 23.2.1975, M. A. FISCHER), and on the islands (island Sipan: Mjekov Tor, in vineyard, 11.3.1979, M. HEĆIMOVIĆ, ZA!, not listed, however, by M. HECIMOVIC 1981, 1984; - Istria: islet Sv. Katerina nr Rovinj, TOMMASINI, W!). The specimens in SCHLOSSER's herbarium (ZA) labelled as originating from near Samobor and from near Żagreb are not fully improbable but require confirmation; some suspicion is also appropriate concerning the records by ROSSI (1924, 1930). Coastal and island distribution, however, is recorded and documented also from adjacent countries (Crna Gora; Greece: FISCHER 1986). We did not see any specimens from Korčula (reported by TRINAJSTIĆ 1985) or from Badija (BARČIC 1974) or from Mljet (REGULA-B. & al. 1981, REGULA-B. & ILIJANIĆ 1984). Concerning recent records (besides *V. polita*) from Slavonia (ILIJANIĆ 1977) without locality data and without documentation, it seems doubtful to us whether they are based on observations in the field and on critical determinations or whether they are simply repetitions of very old literature data. - Ecology: There are not enough reliable data (any Florula recording *V. agrestis* but not *V. polita* should be met with suspicion, because the latter species usually is much commoner) to characterize its ecological behaviour which very probably differs from that of *V. polita* and possibly also from that in Central Europe.

□ *V. opaca* FR. is even much rarer than *V. agrestis*. We saw only two herbarium records: island Sv. Katarina near Rovinj (Istria), M. TOMMASINI, W!; and one specimen (among specimens of *V. agrestis*) on a sheet in SCHLOSSER's herbarium ("in agris fertilibus ad Zagrabiam", ZA!). This species is often misidentified (confused mainly with *V. agrestis* and *V. polita*, characters see in FISCHER 1987). Its main distribution is in NE. Central Europe and NE. Europe.

V. persica POIR. (= *V. tournefortii* C. C. GMEL., *V. buxbaumii* TEN.) is a very common species (a neophyte from N. Iran of hybrid origin which has migrated to Europe not earlier than in the beginning of the 19th century: FISCHER 1987) mainly of arable and ruderal habitats and evidently distributed all over the country. It is reported from a large number of ruderal, segetal and grassland communities (class character species of Stellarietea mediae; Chenopodion muralis, Sisymbrion, Geo-Alliarion, Arction lappae, Eragrostion, Polygono-Chenopodion polyspermi, Polygonion avicularis, Arrhenatherion (HORVATIĆ 1963, MARKOVIĆ-G. 1965, REGULA-B. 1979, 1980, M. HEĆIMOVIĆ 1981, MARKOVIĆ 1982, TOPIĆ 1978, 1982, 1984) and seems to be - correct determinations provided - much more common than *V. polita* and to replace this species, a phenomenon which fits the rather oceanic climate of most parts of the country (in contrast to Central Europe).

V. hederifolia s. l. Up to modern times, this binome was usually used in a fairly large sense, i. e., to designate a group of closely related species (FISCHER 1975b), three of which occur in Croatia (see FISCHER 1985): *V. triloba* (OPIZ) WIESB., *V. sublobata* M. A. FISCH., *V. hederifolia* L. (s. str.).

● *V. sublobata* is only recently (FISCHER 1985) distinguished from *V. hederifolia* s. str. though at least as much different as *V. triloba*. Its most conspicuous and important diagnostic characters are the pale (lilac) corolla without a demarcated white centre, the short style (0.3-0.6 mm), the long pedicel in fruit (3-4 × sepal length) and the seeds with a strongly involute, glossy margin (for details see FISCHER 1985). We found herbarium records from Zagreb and environment (Sestine), from Samobor, from the Ivančica mts (Lepoglava), from the Kalnik mts, and from Karlovac. *V. sublobata* is probably not rare in central and eastern Croatia but less frequent to absent in the mediterranean region in the SW. and in the S. It seems to avoid warm winter but to neglect the summer climate (its distribution ranges from oceanic W. Europe to the subcontinental parts of E. Europe and the Balkan Peninsula. - Ecology (data from C. Europe): Shady and subhumid habitats: deciduous forests with rich soil, particularly riparian forests, groves, orchards, subruderal hedges, as a weed in ± shady gardens; it is uncertain whether it grows also in arable land. Apparently, however, its coenological behaviour seems to be different in Croatia from that in Central Europe, as it is missing in the Anthriscetum trichospermi (Geo-Alliarion) and evidently replaced there by *V. hederifolia* s. str. (MARKOVIĆ 1982).

□ ***V. triloba*** (OPIZ) WIESB. is recorded by FISCHER (1985, with dot map of the total distribution range: fig. 3 between pp. 70 and 71) for 4 localities on the coast. Now we found a few further records which are likewise coastal: "In cultis vallis Senjska Draga", 14.4.1887, ROSSI, ZA!; "Lišanj ad Novi" [Vinodolski], 11.5.1914, ROSSI, ZA!; "ad Jablanac", 5.5.1917, ROSSI, ZA!. It is reported for the islands Korčula (TRINAJSTIĆ 1985) and Biševo (PAVLETIĆ 1974). Its ecogeographic behaviour is ± opposite to that of *V. sublobata*: It seems to be not very rare in arable land in submediterranean regions. The primary (autochthonous) distribution is probably in E. Mediterranean (see FISCHER 1989a) and Anatolian mountains, the secondary (synanthropous) distribution as a weed in arable land enlarges this range by the continental parts of the eastern Balkan Peninsula and towards the xerotherm subcontinental parts of Central Europe (E. Austria, central Bohemia, S. Germany) as well as to the mediterranean regions along the Adriatic coast (FISCHER 1985, 1986) and to the central and western mediterranean countries. *V. triloba* seems to be missing, however, in inland Croatia, i. e., it probably avoids regions without a dry summer. - The most conspicuous diagnostic characters are the dark blue corolla, the short pedicels in fruit (1-2 × sepal length), the usually shortly pubescent sepal surface and the different seed shape (no involute margin!); an exact determination, however, in many cases is possible only when regarding all diagnostic characters together, because all the three species of the group are rather variable, and single characters are often not decisive but deceitful (for details, a comparative table of all differential characters and a numerical key for determination see FISCHER 1985). Further studies on the exact delimitation between these species in respect to morphological, karyological, ecological and distributional characters, especially in the Balkan Peninsula, would be rewarding.

□ ***V. hederifolia*** L. (s. str.) seems to be distributed all over the country, to be rather common in coastal areas and on the islands (e. g. on Brač: ŠTAMOL & MARKOVIĆ 1985); it grows in segetal communities, often together with *V. triloba* (see also above under *V. hederifolia* s. l. and *V. sublobata* and *V. triloba* and FISCHER 1985), but also in ruderal places (to a larger extent than in C. Europe). - Coenology (some records might refer to *V. hederifolia* s. l.!): Arction lappae (MARKOVIĆ-G. 1965), Polygonion avicularis (Istria: ŠEGULJA 1970), Geo-Alliarion (Zagorje: REGULA-B. 1979, MARKOVIĆ 1982) where it seems to replace *V. sublobata* (see above!).

V. cymbalaria BOD. is strictly confined to the mediterranean vegetation along the coast and on the islands but rather common within this whole area from Istria to the Crna Gora boundary (it is recorded for many islands and probably grows on all of them; Balkan Peninsula distribution: FISCHER & FISCHER 1981: 194, 228: Fig. 8). *V. cymbalaria* is rather variable (shape of leaves/bracts, indument) and comprises two polyploid levels: 4x and 6x (FISCHER 1975a, 1976, 1981) but so far no chromosome counts are available for the country. The closely related but clearly distinct, well distinguishable and rather monomorphic diploid *V. panormitana* TINEO (subsp. *panormitana*) is missing in Croatia, its northernmost locality is the island of Kerkira (= Corfu). (*V. panormitana* is often mistaken with glabrous specimens of *V. cymbalaria* which are not rare ("var. *glaberrima* FREYN": RECHINGER 1934, S. HEĆIMOVIĆ 1982). - Ecology: Its primary habitats are probably fissures of calcareous rocks (Asplenio-Umbilicetum horizontalis, Limonietum anfracti: M. HEĆIMOVIĆ 1981) and therophytic communities on gravel etc., but it is much more common on ± ruderal walls and in arable land (often together with *V. hederifolia* and *V. triloba*; hoe weed communities: M. HEĆIMOVIĆ 1981) and in ruderal sites (Hordeo-Sisymbrietum orientalis subass. Tortulae muralis: HORVAT & al. 1974: 128).

Perennials with lateral inflorescences only ("sectt. *Chamaedrys*, *Veronica* and *Beccabunga*"):

"Sect. "*Chamaedrys*":

V. austriaca group sensu WALTERS & WEBB (1972) and FISCHER (1973a) comprises, in Croatia, ***V. prostrata***, ***V. jacquinii***, ***V. orbiculata***, ***V. teucrium***. It is a taxonomically polymorphic and difficult group (WATZL 1910) consisting of several parallel polyploid series (SCHEERER 1937, 1949) with a lot of unsolved problems. *V. prostrata* (s. str.), however, is a comparatively uniform and well distinct diploid taxon.

● ***V. prostrata*** L. (s. str.) is a pronouncedly eastern, continental species (see map of its Balkan Peninsula distribution in FISCHER & FISCHER 1981: 228, fig. 8). This species is not mentioned by DOMAC (1984), evidently by mistake, since there are records for several localities by SCHLOSSER & VUKOTINOVIĆ (1869), NEILREICH (1868: 136) and herbarium specimens from the Kalnik mts (Gornja Rijeka [= "Reka"], SCHLOSSER, ZA) and from the Zagorje (Golubovec, 23.8.1854, WORMASTINI) and a sheet in SCHLOSSER's herbarium (no locality, no. 1450; quoted by HIRC 1904: 188). This species is probably much more distributed in the (climatically) continental parts of Croatia, i. e. in N. Slavonia, in the Podravina, and especially in Baranja, viz. in steppes within the climax region of the Aceri tatarici-Quercetum (JOVANOVIĆ & al. 1986; see also the remarks by FISCHER & BEDALOV (1989: under *Pseudolysimachion pallens* and *P. spurium*). (For ecology and general distribution see FISCHER & FISCHER 1981.)

V. austriaca s. l. (sensu WALTERS & WEBB 1972) comprises (among others) the subsequent four taxa which are often treated at (different) infraspecific ranks and need much more investigation, but eventually it might turn out that they are distinct species: *V. jacquinii*, *V. orbiculata*, *V. dentata*, *V. teucrium* (the first 3 constitute *V. austriaca* sensu WATZL 1910).

V. jacquinii BAUMG. (= *V. austriaca* subsp. *austriaca* sensu WALTERS & WEBB, *V. austriaca* subsp. *jacquinii* (BAUMG.) B. WATZL, *V. multifida* sensu SCOPOLI, sensu KERNER et sensu auct. al.; incl. *V. bihariensis* KERNER) is an extremely variable and underinvestigated species apparently common in Croatia except for the regions south of approximately between 43° and 44° (especially S. of Split) where it seems to be replaced by *V. orbiculata*. General distribution of *V. jacquinii*: Balkan Peninsula and W. Anatolia. - Ecology: character species of the Bromo-Plantaginetum (Bromion erecti: HORVAT 1931a, HORVATIĆ 1962) and/or of Bromion erecti (GAŽI-BASKOVA & SEGULJA 1978) and/or of Festuco-Brometea (TRINAJSTIĆ & al. 1981), as companion in the Bromo-Danthonietum calycinae (SUGAR 1973) and Festuco-Armerietum canescentis (TRINAJSTIĆ & ŠUGAR 1972), but also in Festucion pungentis (Seslerietalia juncifoliae; Velebit: HORVAT 1930).

Our knowledge about this species and its possible delimitation against *V. orbiculata* is very unsatisfactory. Following WATZL (1910) (and HAYEK 1929) differential characters should be:

V. jacquinii	*V. orbiculata*
Ca. 20-50 cm high, erect; all leaves usually pinnatifid including the uppermost ones (above the inflorescences), middle leaves often bipinnatifid; stem, leaves, and calyx usually ± strongly hirsute; capsule obovate to obcordate, pubescent or glabrous. - Hexaploid (2n = 48) (SCHEERER 1937; no modern confirmation).	Ca. 10-30 cm high, ascending; lower leaves undivided, ovate, crenate, middle leaves usually ± pinnatifid, uppermost ones (above the inflorescences) linear, entire; stem, leaves, and calyx shortly pubescent, subglabrous or glabrous; capsule orbicular, subglabrous or glabrous. - Tetraploid (2n = 32) (SCHEERER 1937; no modern confirmation).

□ *V. orbiculata* A. KERNER (= *V. austriaca* subsp. *orbiculata* (A. KERNER) MALY ex WATZL; - *V. dentata* var. *bihariensis* sensu DOMAC) grows mainly in southern Dalmatia; though not treated by DOMAC (1984), it is recorded in the literature for several localities: Korčula (TRI-

NAJSTIĆ 1970a, 1985), Pelješac, Hvar (RECHINGER 1934), Sipan (M. HEĆIMOVIĆ 1982), Lopud (HEĆIMOVIĆ & HEĆIMOVIĆ 1986), Lokrum (S. HEĆIMOVIĆ 1982), and for mt Srdj (Dubrovnik: M. HEĆIMOVIĆ 1981, BIRAČ 1973). The specimens from mt Biokovo (as "*V. austriaca* subsp. *dentata*", 2.7.1958, DOMAC, ZA!) match *V. orbiculata* quite well. - The relations of *V. orbiculata* to *V. jacquinii* (see above) and its taxonomic value are still unclear. - General distribution of *V. orbiculata*: approximately (S.) Dalmatia, Hercegovina, Bosnia (?), Crna Gora. - Coenology: It is character species of the Cisto-Ericion (Cisto-Ericetalia, Quercetea ilicis) (HORVATIĆ 1958, HORVAT & al. 1974), particularly char. sp. of Erico-Cistetum cretici and Genisto-Ericetum verticillatae (HORVATIC 1958, 1963, M. HECIMOVIC´ 1982, BIRAČ 1973), it occurs also in Orno-Quercetum ilicis pinosum dalmaticae (Quercion ilicis), and in associations of the Ostryo-Carpinion: Seslerio-Ostryetum pinosum dalmaticae, Stipo-Salvietum officinalis pinetosum dalmaticae, Junipero-Pinetum dalmaticae (Brač and mt Biokovo: DOMAC 1965, the Biokovo records as "*V. dentata* subsp. *austriaca*") and in Chrysopogoni-Saturejon (BIRAČ 1973) and Vulpio-Lotion (M. HEĆIMOVIĆ 1981).

** *V. dentata* F. W. SCHMIDT (= *V. austriaca* subsp. *dentata* (F. W. SCHMIDT) WATZL, *V. austriaca* s. str. sensu auct. austriac., sed non sensu WALTERS & WEBB 1972) does not grow in Croatia. Its distribution area ranges from S. Germany, E. Austria to Czechoslovakia, Hungary, Roumania, Ukraine. - "*V. (austriaca* subsp.) *dentata* var. *bihariensis*" sensu DOMAC 1960, 1965, 1984, non (A. KERNER) HAYEK (reported for mt Biokovo, in DOMAC 1965 erroneously as "*V. dentata* subsp. *austriaca*") belongs to *V. orbiculata* (see above).

V. teucrium L. (= *V. austriaca* subsp. *teucrium* (L.) D. A. WEBB, *V. teucrium* subsp. *pseudochamaedrys* (JACQ.) NYM., *V. latifolia* L. nec auct. mult.) is apparently rather common in the country except for the southern parts (S. of mt Velebit) and probably rare or even missing in Dalmatia. *V. teucrium* seems to present no major taxonomical problem within Croatia. Some old records for "*V. latifolia*" (like NEILREICH 1868) refer to this species and not to *V. urticifolia*. (SCHLOSSER & VUKOTINOVIĆ 1869: 675 uses the name "*V. latifolia*"

- judging from the locality records - mainly for *V. teucrium*, but the description he gives is a mixture of *V. teucrium* and *V. urticifolia*; under the name "*V. pseudochamaedrys*" he mentions and describes *V. teucrium* for a second time; see also NEILREICH 1869: 799 [= 35].) - Ecology: Very few records exist. We found only: Mesobromion erecti (Hrvatsko Zagorje: REGULA-BEVILACQUA 1983).

V. chamaedrys L. (s. l.) is a highly variable and polymorphic species, also in Croatia. Misidentifications and confusions with other species (*V. teucrium*, *V. montana*), however, are comparatively rare, because *V. chamaedrys* s. l. is well delimited; its polymorphy is an "internal" one which has been studied by including the use of karyological data and has resulted in the distinction of several microspecies and/or subspecies characterized karyologically (diploid or tetraploid), morphologically (mainly leaf shape and indument characters), and ecogeographically (see MIREK & FISCHER 1986, FISCHER 1970, 1973 b, 1989a). Tentative investigations on Croatian plants provided evidence that different taxa are present there, further study of which is strongly required. So far, none of the segregate taxa treated by MIREK & FISCHER (1986) is recorded for Croatia except the single locality of *V. vindobonensis* on mt Troglav mentioned below. *V. chamaedrys* (s. l.) is rather common in most parts of Croatia; towards the south, in submediterranean and mediterranean regions it gets rarer but seems to be present in the mountains. - Ecology: The "polymorphic taxonomy" corresponds to its highly euryoecious ecological and coenological behaviour ranging from various forest communities to different grassland and even segetal communities. A better understanding of its taxonomy would result in taxa of much more restricted ecology (see MIREK & FISCHER 1976). For the time being, however, the indicative value of this "s. l. species" is almost zero: It is reported for Quercetalia pubescentis (order character species: TRINAJSTIC 1982; Querco-Ostryetum carpinifoliae: HORVAT 1938), Quercion roboris-petraeae (HRUŠKA-DELL'UOMO 1975), Ostryo-Carpinion orientalis (HORVAT 1959), Carpinion (HORVAT 1938, 1963, GRAČANIN & al. 1969), Alno-Quercion roboris (HORVAT 1938, GLAVAČ 1968a), Fagion (HORVAT 1938), also in acid forests: Querco-Castanetum (Carpinion: Medvednica) and Vaccinio-Piceion (HORVAT 1938), but also for Arrhenatheretalia (as order char. sp. as well!:

HULINA 1984), Arrhenatherion (HORVAT 1962, ILIJANIĆ 1962, HULINA 1977, REGULA-B. 1980, ILIJANIC & al. 1978, ILIJANIĆ & SEGULJA 1983), Molinion (HORVATIC & al. 1970), Mesobromion (REGULA-B. 1983), Calluno-Festucion tenuifoliae (= capillatae: Arnico-Nardetum, SW. Croatia, HORVAT in HORVAT & al. 1974: 488), Calthion (REGULA-B. 1980, HULINA 1984), Arction (MARKOVIĆ-G. 1965, MARKOVIC 1984), Geo-Alliarion (REGULA-B. 1979, MARKOVIC 1982, 1984), Aegopodion (MARKOVIĆ 1984), Polygono-Chenopodion polyspermae (REGULA-B. 1979).

● *V. vindobonensis* (M. [A.] FISCH.) M. A. FISCH. inhabits a clearly eastern continental distribution range of the pontic-pannonic type (see map and chorological discussion by MIREK & FISCHER 1986), centred in the continental lowlands with exclaves in high altitudes of southern mountains. Within Yugoslavia, accordingly, it has seemed to occur in Serbia and Makedonia only. Recently, however, we came across a remarkable exception: In the herbarium of W. GUTERMANN (Vienna University) we found two gatherings of doubtless and typical *V. vindobonensis* from mt Troglav of the Dinara mt range near the Bosnian border: W. slope of the rocky basin between Mali and Veliki Troglav, calcareous meadows, c. 1500-1600 msm, 8.7.1973, leg. F. EHRENDORFER & W. GUTERMANN, nos. W. G. 10960 and 10980. Possibly, this is a disjunct, isolated locality; the nearest known occurrence is in the Tara mts (Serbia), 220 km to the east. - Within Croatia it might well be expected to exhibit a similar ecogeographical behaviour like *Pseudolysimachion pallens* (and *V. prostrata*?) and to occur in N. Slavonia, particularly in Baranja.

"Sect. Veronica":

V. montana L. is, according to the oceanic to suboceanic climate of most parts of the country, probably wide-spread (but not very common?) in riparian and mountain broad-leaved deciduous forests, in Dalmatia probably at the mountaineous Bosnian border only (FISCHER & FISCHER 1981: 196, 231: map fig. 11). Sometimes, long-petiolate specimens of *V. chamaedrys* are misidentified as *V. montana*. - Coenology: Querco-Carpinetum illyricum in N. Croatia (HORVAT 1963); Genisto-Quercetum roboris subass. caricetosum remotae and Querco robori-

Carpinetum (Alno-Quercion, both riparian forests in the Sava valley: GLAVAČ 1968a); Festuco-Quercetum petraeae of Moslavačka Gora (HRUŠKA-D. 1975).

V. scutellata L. is scattered over almost all Croatia (except probably Dalmatia) (see FISCHER & FISCHER 1981: 197, 232: fig. 12). - Ecology: Magnocaricetalia (Caricion rostratae: RAUS & al. 1978), Calthion (ŠEGULJA 1977b), Deschampsion (HULINA 1977), riparian forests at the Sava river (Alno-Quercion roboris: Leucojo-Fraxinetum parvifoliae: Posavina, GLAVAC 1959, 1968a, HORVAT 1938).

V. urticifolia JACQ. (= *V. latifolia* sensu auct. mult., nec L.) is present in the mountains of almost the whole of Croatia (in Dalmatia at the Bosnian border only), see FISCHER & FISCHER (1981: 187, 226: fig. 6). In the old literature it had been - on nomenclatural reasons - confused with *V. teucrium* (q. v.). - Coenology: Fagion illyricum australe in the valley of the Kupa river (F. i. a. montanum) and in mountains of the SW., e. g. mts Plješevica and Velebit (F. i. a. abietetum) (HORVAT 1938, HORVAT & al. 1974); order character species of Vaccinio-Piceetalia in W. Croatian mts (HORVAT 1938, 1962, which is somewhat surprising to us because in the abovementioned Fagion communities as well as in the Alps it shows a clear basiphilous tendency); Ostryo-Fagetum (TRINAJSTIC 1972). Surprisingly, this species is recorded also for heliophile grassland and rocky communities (Caricetum firmae: HORVAT 1930; Potentilletum clusianae: HORVAT 1931b).

V. officinalis L. occurs in all Croatia, including also some Dalmatian mountains, see FISCHER & FISCHER (1981: 196, 230: fig. 10). - Ecology: Indicator of acid soil in several very different communities. It is class character species of Nardo-Callunetea (ILIJANIC 1972), alliance character species of Calluno-Festucion capillatae (= tenuifoliae; HORVAT 1962, HULINA 1973, 1977); it grows in Quercion robori-petraeae (HORVAT 1963), Querco-Castanetum (Carpinion: HORVAT 1938), in Vaccinio-Piceion (HORVAT 1963, TRINAJSTIĆ 1974), but, surprisingly, also in Fagion (Velebit: HORVAT 1938), in

Bromion erecti (ŠUGAR 1973), in Arrhenatherion (HORVAT 1962, HRUŠKA-D. 1976, REGULA-B. 1980), in Deschampsion cespitosae (HULINA 1977), and even in Festucion pungentis (HORVAT 1930).

V. aphylla L. is present in the S. Velebit mts (on Vaganski Vrh: ROSSI 1924, DEGEN 1938, VOLARIĆ-MRŠIĆ 1972; we saw specimens in ZA: "in alpe Vaganski Vrh, 1758 m, supra Medak", 31.7.1909, leg. ROSSI; and from "in alpe Golić 1637 supra Medak" [?], 27.7.1901, leg. ROSSI) and at the Bosnian border in the Dinara range on mt Troglav and on mt Kamešnica. The range of this species, thus, does not show the "Croatian Gap" (Balkan Peninsula distribution: FISCHER & FISCHER 1981: 186, 225: fig. 5). - Ecology: Arabidion coeruleae (HORVAT 1931b), Drypetum spinosae subsp. linneanae and Cerastietum dinaricae (both Thlaspeion rotundifolii; VOLARIC-MRSIC 1972: 217).

"Sect. *Beccabunga*":

V. anagallis-aquatica L. (subsp. *anagallis-aquatica*) is apparently distributed all over the country, including the mediterranean parts. The specimens from "Žrnovnica kod Sv. Juraj" [c. 10 km S. of Senj] (3.7.1896, ZA: nos 10924, 10925), determined by DEGEN as *V. anagalloides* (ROSSI 1924: 163) belong to *V. anagallis-aquatica*. - Ecology: It exhibits an ecological range almost as large as *V. beccabunga*, although these two species behave distinctly different and do not often grow together. *V. anagallis-aquatica* is recorded from Phragmitetalia (BIRAČ 1973, RAUS & al. 1978, HORVATIC 1931, 1963), Magnocaricetalia (ŠEGULJA 1976), Agrostietalia (MARKOVIĆ 1984), Bidentetalia (MARKOVIĆ 1975), but also from Juncetea maritimi (BIRAC 1973) and from Alno-Quercion roboris (Posavina: GLAVAČ 1959). DOMAC (1968) assigns this species to four of E. SCHMID's Vegetationsgürtel, among them, amazingly, also to the Vaccinium-uliginosum-Loiseleuria-Gürtel which is "restricted to the highest mountain peaks of Yugoslavia".

● *V. catenata* PENNELL (= *V. aquatica* BERNH.) has, strangely, never been recorded for the country (because not distinguished from *V. anagallis-aquatica*). We saw the following herbarium material: "Ad

Zagreb versus fluvium Sava", 30.6.1913, ROSSI, ZA!; "Karlovac: Uz Mrežnica kod Dolnje Švarče, 6.9.1917, ROSSI, ZA!; "Litorale croaticum: in valle Dumboko prope Sv. Juraj" [probably near Jurjevo, c. 7 km S. of Senj], 5.6.1913, ROSSI, ZA!; Istria: "Pola [= Pula], Sumpfgräben in Prato Grande", 24.5.1904, UNTCHJ, PRC!; Dalmatia: Biograd na moru, in paludibus ad lacum Vrana, 5.6.1928, G. CUFODONTIS, W!. - *V. catenata* grows in similar habitats (?) like the preceding species, differs by being usually annual, by leaves all sessile and narrower, raceme usually ± sparsely glandular-pubescent, pedicels shorter and almost horizontally patent, corolla white or pinkish (see also WALTERS & WEBB 1972, HARTL 1968, FISCHER 1982, FISCHER & al. 1985). This species is wide-spread in Central and W. Europe (MEUSEL & al. 1978). It is present also in Slovenia (though not reported by FISCHER & WRABER 1984), as well as in Bosnia (Sarajevsko polje), Serbia, Makedonia, and Albania (not reported by DEMIRI 1983) (FISCHER, ined.). - Coenology: unknown for Croatia. ("*V. aquatica*" by HORVATIC 1934 and 1963: 132 probably refers to *V. anagallis-aquatica*; in HORVATIĆ 1963 both names, "*V. aquatica*" and "*V. anagallis*", evidently are treated as synonyms).

□ *V. anagalloides* GUSS. is recorded for the country since old times (SCHLOSSER & VUKOTINOVIĆ 1869, HORVATIĆ & al. 1968, ILIJANIĆ 1977, REGULA-B. & ILIJANIĆ 1984) but has been neglected or is rare; sometimes it is misidentified (like the record in ROSSI 1924 which refers to *V. anagallis-aquatica*, see above; for doubtful records see also ROSSI 1930 and DEGEN 1938). We saw only specimens from "im Eisenbahn-Graben bei Agram" [= railway ditch near Zagreb] (1878, herb. SCHLOSSER, ZA!) and from Istria (Pula: marshland ditches, "Prato grande", 20.6.1900, UNTCHJ, E!; - Pula: Foiba, 5.1887, RAIMANN, W!). - The diagnostic characters given by DOMAC (1984) are not complete and not satisfactory. It is annual, has narrow, always sessile leaves, often in whorls of 3-4, many racemes which are rather densely glandular-pubescent, the corolla is pale purplish, the capsule elliptic, the style short (0.8-1.5 mm) (NEILREICH 1867, FISCHER 1978, 1982, FISCHER & WRABER 1984, FISCHER & al. 1985). - Chorology and Ecology: It is a wide-spread submediterranean species of eutrophic muddy habitats, wet arable land, periodically dry ditches etc., viz. character species of Cypero-Paspaletum digitarii

(Fimbristylion dichotomae) in Dalmatia (HORVATIĆ 1954); companion of Polygono-Chenopodietum (Chenopodion fluviatilis) at the river Sava (MARKOVIĆ 1980).

V. beccabunga L. (subsp. *beccabunga*) seems to be distributed all over the country and to show, astonishingly, a large coenological amplitude (we cannot exclude possible misidentifications of *V. anagallis-aquatica*) ranging from Phragmitetalia (character species of Glycerio-Sparganion: HORVAT 1962, HORVATIĆ 1931, 1963, TRINAJSTIĆ & al. 1985) to Magnocaricetalia (ŠEGULJA 1976), Potamogetonetalia (HULINA 1973), but also to Agrostietalia (MARKOVIĆ 1973, 1978), Molinietalia (REGULA-B. 1980) and Bidentetalia (MARKOVIĆ 1975, 1980, REGULA-B. 1979) and even to Isoeto-Nanojuncetea (Fimbristylion dichotomae in Dalmatia: HORVATIĆ (1954).

* *V. scardica* GRISEB. is not recorded for Croatia so far in a precise way, but it might occur in SE. Slavonia (FISCHER & FISCHER 1981: 198, 228). It is a mainly serpentinophytic species ranging from SE. Austria and Hungary over the Balkan Peninsula to Anatolia (FISCHER 1978). For detailed diagnostic characters see FISCHER & al. (1985) and FISCHER (1989a).

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Sažetak

ROD *VERONICA (SCROPHULARIACEAE)* U FLORI HRVATSKE

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Na osnovu revizije herbarskog materijala iz herbarskih zbirki ZA i ZAHO (Zagreb), te W i WU (Beč) donosimo neke ispravke i dopune o prisustvo i rasprostranjenosti pojedinih vrsta roda *Veronica* u flori Hrvatske.

Tri vrste, koje su se do sada u literaturi navodile, vrlo vjerojatno ne dolaze u Hrvatskoj ili nisu dosad bile sa sigurnošću utvrdjene, stoga bi ih trebalo brisati iz flore Hrvatske (označene u tekstu sa **): *V. fruticulosa*, *V. fruticans*, *V. dentata* (= *V. austriaca* subsp. *dentata*); dvije vrste nisu do sada bile zabilježene, ali bi se još možda mogle naći (*): *V. dillenii*, *V. scardica*; četiri vrste, koje su dosad bile nepoznate, ili su bile zanemarene u modernim standardnim Florama, potvrdjene su ili zabilježene prvi put (●): *V. sublobata*, *V. prostrata*, *V. vindobonensis*, *V. catenata*; deset vrsta je još uvijek u izvjesnom pogledu problematično (□): *V. alpina*, *V. praecox*, *V. triphyllos*, *V. verna*, *V. agrestis*, *V. opaca*, *V. triloba*, *V. hederifolia* s. str., *V. orbiculata*, *V. anagalloides*. - Neriješeni taksonomski i/ili ekogeografski problemi vrste *V. serpyllifolia* i skupnih vrsta *V. agrestis*, *V. hederifolia*, *V. austriaca*, *V. chamaedrys*, *V. anagallis-aquatica* navedeni su i/ili raspravljani. Ukratko su prikazane ekogeografske (uključujući fitocenološke) osobine svih vrsta koje dolaze na području Hrvatske.

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